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The spring plankton is characterized by the predominance of diatoms and a great increase in the amount of ash, which precludes any direct comparison with land plants. If, however, the comparison be based upon the ash-free substance of the diatoms, it is found that this differs from the richer food plants only in the greater proportion of fat, as the following table shows.

PER CENT DRY WEIGHT.	ALBUMEN.	FAT.	CARBO-HYDRATES.
Lupine — extra quality	29.3	2.8	67.8
Peas (kernels)	27.2	2.3	70.4
Diatoms	28.7	8.0	63.2

The summer plankton is predominantly animal, and thus presents a large amount of albumen, a fat-content at times low, at times abnormally high, and a relatively very small amount of carbohydrates. In these particulars its analysis resembles those of fish, mussels, and other marine animals.

C. A. K.

ZOOLOGY.

Morphology of Trematodes. — An interesting contribution to trematode morphology is contained in the recent paper by Pratt in the *Zoologische Jahrbücher*.[1] An investigation of *Apoblema appendiculatum* has brought to light a condition of the body covering which throws light upon the unsettled question concerning the nature of the outer layer of the body, or "cuticula," in trematodes and cestodes. Five principal views have been advanced concerning the nature of this layer. The older view of Schneider ('73) and Minot ('77) was that the layer is a basement membrane from which the overlying epithelium has been lost. Ziegler ('83) made the suggestion that the cuticula is to be regarded as an epithelium in which the nuclei, cell boundaries, etc., have become obliterated, a view which has attained considerable acceptance from the support given it in recent years by the writings of Braun and Monticelli. Brandes ('92) advanced the view that the layer arises as a secretion of the submuscular cells which he considered to be glandular in function. Looss ('93) argued that the cuticular layer arises by the migration to the surface of the body of a material set free in the vacuolization of the parenchyma cells. These he believed to be derived from the layer of submuscular cells, which he compared to a Cambrian layer in plants. A fifth view was put forward by Blochmann ('96). According to his ingenious explanation, the outer body covering is a true cuticula secreted by a layer of epithelial cells which have elongated backward and come to lie beneath the layers of muscle fibres. They are more or less separated from one another and connected with the cuticula only by narrow processes extending between the muscle fibres and comparable with the ducts of gland cells.

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[1] Pratt, H. S. A Contribution to the Life-History and Anatomy of the Appendiculate Distomes, *Zoologische Jahrbücher*, Abth. f. Anat., Bd. xi (1898).

Apoblema is an appendiculate trematode, and it is upon the cuticular layer covering the caudal appendix that the observations of special interest were made. In the earlier part of its life, passed within the body of a copepod, the caudal appendix is present only in the form of an invagination of the posterior end of the worm forming the caudal vesicle. Later, when the animal becomes free living, the caudal vesicle becomes everted to form the caudal appendix. After this has taken place there is no difference to be observed between the cuticular covering of the appendix and that of other parts of the body. It is a typical trematode cuticula destitute of spines and divisible into two layers, an outer and a deeper one, as shown by differences in reaction toward stains. Immediately beneath the cuticula are the usual layers of muscle fibres, circular and longitudinal, and the layer of submuscular cells. In the appendix, however, the latter layer is absent.

In the condition when the appendix is invaginated to form the caudal vesicle its cuticular layer is covered externally (toward the lumen of the vesicle) by a layer of columnar epithelial cells, over which is a delicate membrane — a true cuticula. In other words, in the caudal vesicle the layer which is later to become the cuticular covering of the appendix has precisely the relations of a basement membrane. About the time that the vesicle becomes evaginated to form the appendix, the layer of epithelial cells separates from the cuticular layer upon which it rests. Evidence for this, Pratt found in the presence of shriveled epithelium in the caudal vesicle nearly separated from the underlying cuticula.

This evidence from Apoblema furnishes strong support for the older theory that the body covering represents what was primarily a basement membrane. Pratt takes this view, but argues that the layer has been modified and thickened by the addition to it of connective-tissue material from the deeper lying parenchyma. That the submuscular cells do not secrete this material is shown by the fact that the submuscular layer is absent from the caudal appendix of Apoblema, though the cuticular layer is as well developed there as over other parts of the body. It will be seen that the view which Pratt advocates is essentially the theory of Looss grafted upon the older view of Schneider and Minot. The evidence which he brings forward strongly antagonizes the views of Ziegler, Brandes, and Blochmann.

Pratt's account of the life-history of Apoblema differs from that given by previous investigators. He believes that the copepod is the primary host within which the young worm lives until it is nearly mature. It then escapes from the body of the copepod by forcing its way outward between two thoracic segments — a process which the author observed repeatedly. The young worm, while swimming about freely in the water, is probably swallowed by some fish, which thus becomes its final host.

W. S. NICKERSON.

Michigan Unionidæ.[1] — The distribution of the Unionidæ of Michigan has been worked out by Mr. Bryant Walker from a census which the Conchological Section of the Michigan Academy of Science has taken of all the known public and private collections within that state. Michigan possesses the richest unione fauna of all the territory tributary to the Great Lakes, and, as the state is wholly within the St. Lawrence basin, the problem is not complicated by the political boundaries of the investigation. Sixty-one species belonging to the genera Unio, Margaritina, and Anodonta are recognized. Of these only a small number have a general distribution; a few are peculiar to the northern part of the state; and several are confined to Lake Erie and the waters immediately tributary to it. On the other hand, a great majority of the total number (75 per cent of the species of Unio and Margaritina) are confined to the Grand-Saginaw valley and the region to the south of it. These forms are members of the fauna of the Mississippi basin, while those of the southeastern part of the state show decided affinities to the Ohian fauna. But two species peculiar to the fauna of the Atlantic region are found, and these have a general distribution throughout the state. Their westward migration could have taken place readily along existing waterways. On the other hand, the explanation of

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[1] Walker, Bryant. *The Distribution of the Unionidæ in Michigan.* Detroit, 1898. Printed for the author. 20 pp., 3 pls.